



IMMERSIFY

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Audiovisual Technologies for Next
Generation Immersive Media

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Immersify Project

Intro

- Audiovisual Technologies for Next Generation Immersive Media
- October 2017 – March 2020
- EU H2020 Innovation Action
- Total funding: 2.5 m €



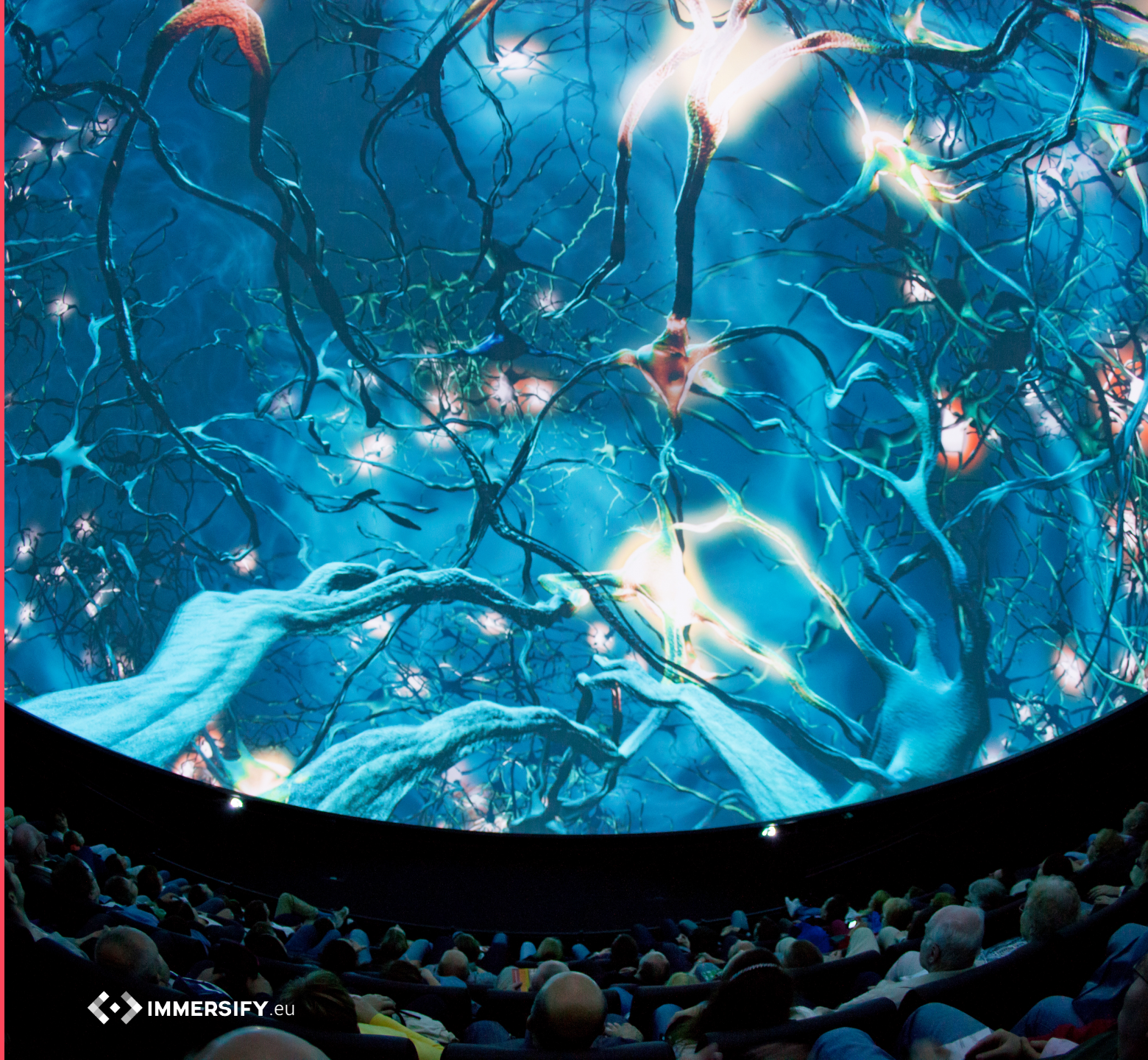
Project Partners

- Poznan Supercomputing and Networking Center - PSNC (Poznan, PL)
- Spin Digital Video Technologies GmbH (Berlin, DE)
- Ars Electronica Futurelab (Linz, AT)
- Marché du Film – Festival de Cannes (Cannes, FR)
- Visualization Center C (Norrköping, SE)

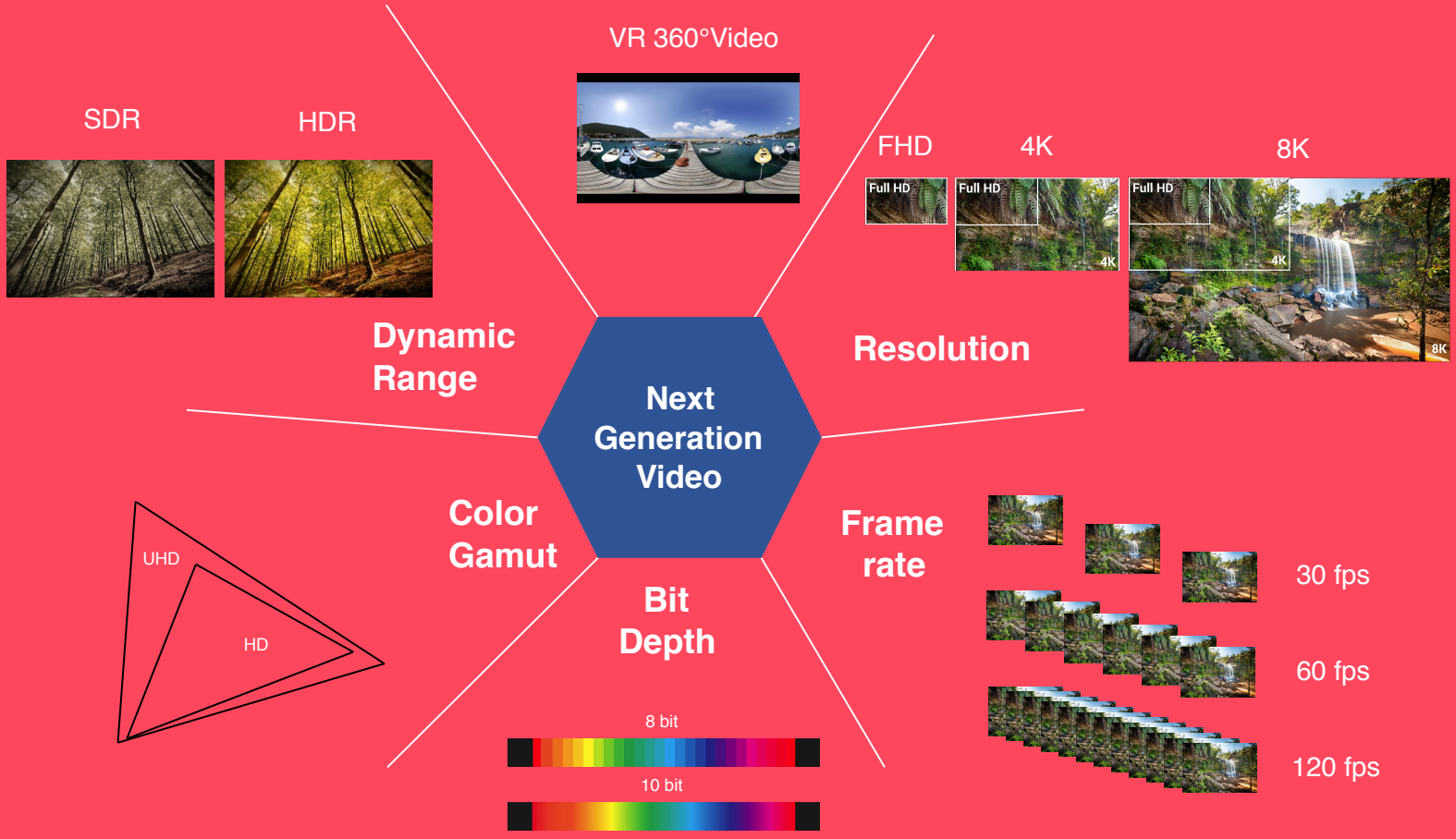


Next Generation Immersive Media

- Immersive: seeming to surround the audience so that that they feel completely involved
- Ultra high resolution (>8K)
- 360° and panoramic video
- Interactive and non-linear
- Immersive & 3D audio



Next Generation Video: Beyond Resolution



Objectives

- Video codecs: improve quality using advanced compression technology
- Multi-Display: enable immersive media for multiple display environments
- Interactive: provide tools for personalized and interactive non-linear storytelling
- Content and Tools: promote immersive media in the creative industries



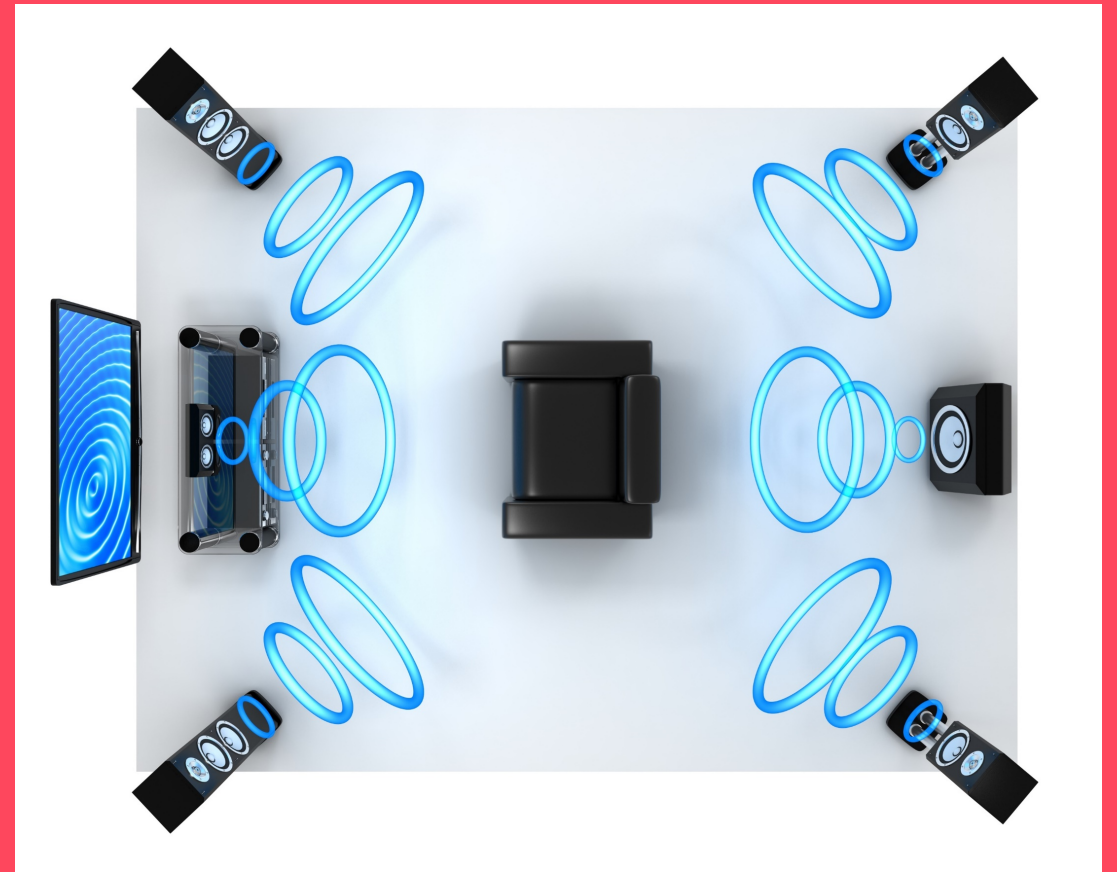
Immersive audio in Immersify

Immersify does not intend to develop innovations in audio coding technology

Integrate existing formats and tools for spatial audio into VR media playback and streaming solutions

Multichannel up to 22.2, audio objects and ambisonic

Experimental content production and technology testing



Ambisonics test and experiments

Main objectives

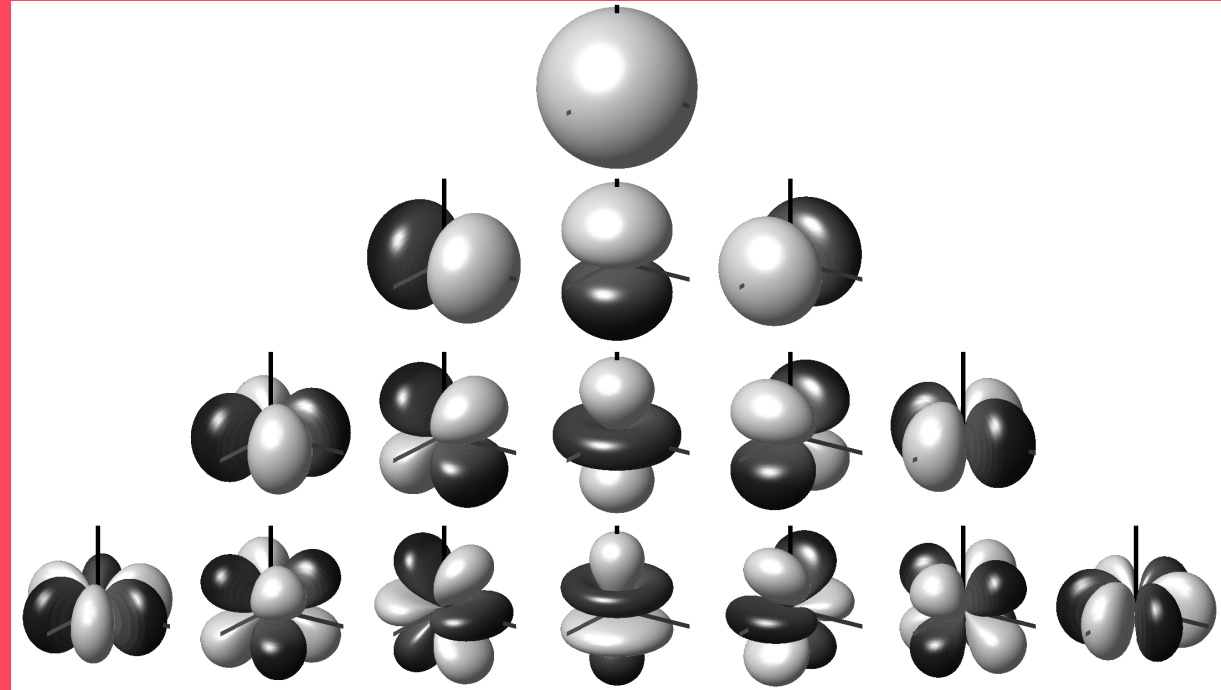
- › Obtain music content for work and experiments with 3D Audio
- › Prepare and build monitoring system
- › Make appropriate workflow for such realizations
- › Do tests connected with binaural reproduction of 3D audio
- › Combination 3D audio with VR technologies



Ambisonics test and experiments

Ambisonics?

- Developed in 1970 at British National Research Development Corporation
- Speaker - independent representation of sound field based on spherical harmonics
- Today the most popular ambisonics format is **ambisonics B format**



Recordings

- We had to find interesting band with wide line up and varied material
- We invited the jazz band „Anomalia” to cooperate with us
- We had to figure out the way of recordings for such realization
- We recorded all event in 8K and 360°



Recordings



Recordings



Recordings

List of microphones

- › Trombone - DPA 4099
- › Trumpet - Se Electronics Voodoo VR1
- › Tenor saxophone - Se Electronics Se2200a II, DPA 4099
- › Alt saxophone - DPA 4099
- › Guitar - Audio Technica AT 2050, Shure sm 57
- › Doublebass - DPA 4099, line from bass amplifier
- › Drums
- › Ambience - Sennheiser AMBEO VR MiC

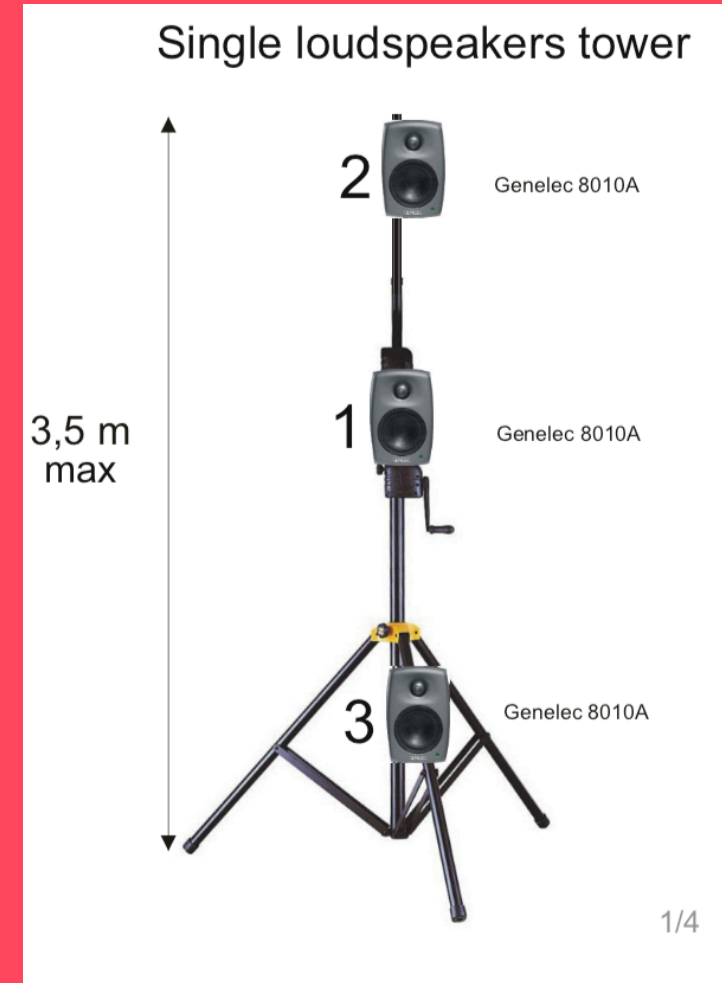
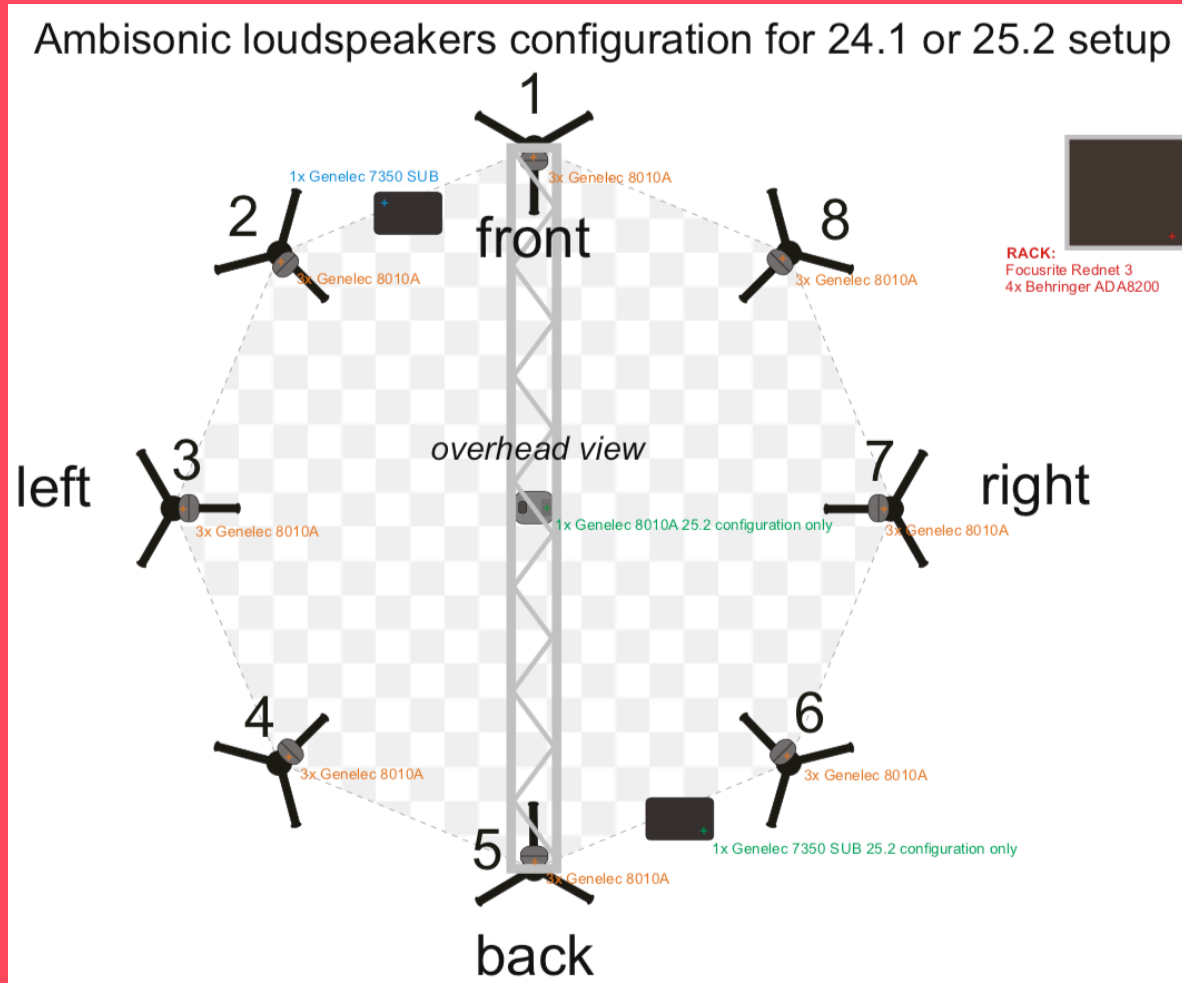


Monitoring system

- Spherical ambisonics monitoring system
- Consist of 24 loudspeakers and one subwoofer
- Speakers located on 3 hexagonal planes
- All system operated with Audinet Dante protocol
- Whole installation is based on easy removal segment which allow us for fast assembly




Monitoring system









Ambisonic audio installation at Poznan Supercomputing and Networking Center

Monitoring system

Connection

Computer with Reaper



Focusrite rednet 3



4x Behringer ADA 8200



24x genelec 8010a
1x genelec 7350 sub



Dante protocol



4x ADAT



Up to 32 physical
outputs

Mix

- Find appropriate tools (DAW, plugins etc.)
- Elaborate own workflow
- Change our thinking about mixing in order to 3D audio

The screenshot displays a digital audio workstation (DAW) interface for 3D audio mixing. The interface is divided into several sections:

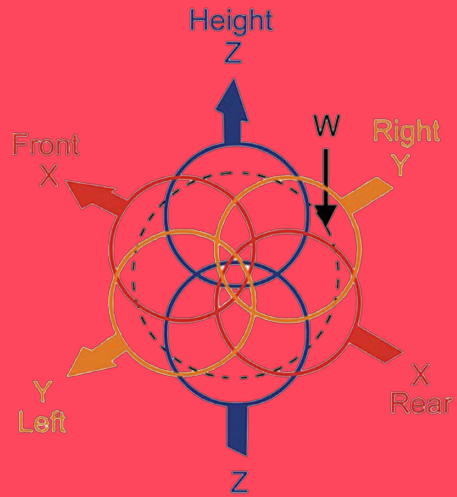
- Top Panel:** Shows the transport and master section. The transport controls include play, stop, and record buttons. The master section shows the tempo set to 103.100 BPM and the time at 3:24.000 [Stopped].
- Mixing Console:** The central part of the interface shows a list of tracks and buses. The tracks are:
 - Headphones (1)
 - Loudspeakers (2)
 - Ambisonic Bus (3)
 - kick (4)
 - snare top (5)
 - sn btm (6)
 - hh (7)
 - t1 (8)
 - t2 (9)
 - ov_l (10)
 - ov_r (11)
 - contra_mic (12)
 - contr_line (13)
 - git_sm57 (14)
 - git_at2050 (15)
 - sax sopran (16)
 - sax tenor dpa (17)
- Waveform View:** The right side of the interface shows a large waveform display for the Ambisonic Bus (3) and individual tracks for the kick, snare, and guitar tracks. The Ambisonic Bus waveform shows a complex, multi-channel signal.
- Plugin Rack:** A small window on the right side shows the plugin rack, with VST: SceneR selected.
- Bottom Panel:** The bottom of the interface features the IMMERSIFY.eu logo and a control bar with play, stop, and record buttons, along with a CPU usage indicator showing 0.6%/0.6% CPU usage.

Mix

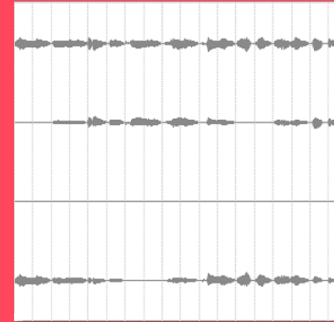
Mono or stereo
audio track



Source spatializing



B format
multichannel audio



Any ambisonics
monitoring system



Encoding stereo or mono
audio to B format



Exporting audio as
B format multichannel



Decoding for any ambisonics
monitoring system or headphones



Mix

Tools

The screenshot shows a DAW interface with several audio processing windows. The top window is 'EnergyVisualizer (EM) (64ch) - Master Track [3/4]', which displays a 3D energy field visualization. The middle window is 'StereoEncoder (EM) (64ch) - Track 12 *GIAAT2050* [1/2]', which shows a 2D stereo field visualization and control parameters for Azimuth, Elevation, Roll, and Width. The bottom window is 'AIIRADecoder (IEM) (64ch) - Master Track [1/4]', which displays a 3D decoder layout and a table of loudspeaker parameters.

ID	Azimuth	Elevation	Radius	Channel	Imaginary	Gain	Noise	Remove
1	0°	0°	1	5		1	Noise	Remove
2	45°	0°	1	2		1	Noise	Remove
3	90°	0°	1	23		1	Noise	Remove
4	135°	0°	1	20		1	Noise	Remove
5	180°	0°	1	17		1	Noise	Remove
6	-135°	0°	1	14		1	Noise	Remove
7	-90°	0°	1	11		1	Noise	Remove
8	-45°	0°	1	8		1	Noise	Remove
9	0°	45°	1	4		1	Noise	Remove
10	45°	45°	1	1		1	Noise	Remove
11	90°	45°	1	22		1	Noise	Remove

Binaural representation

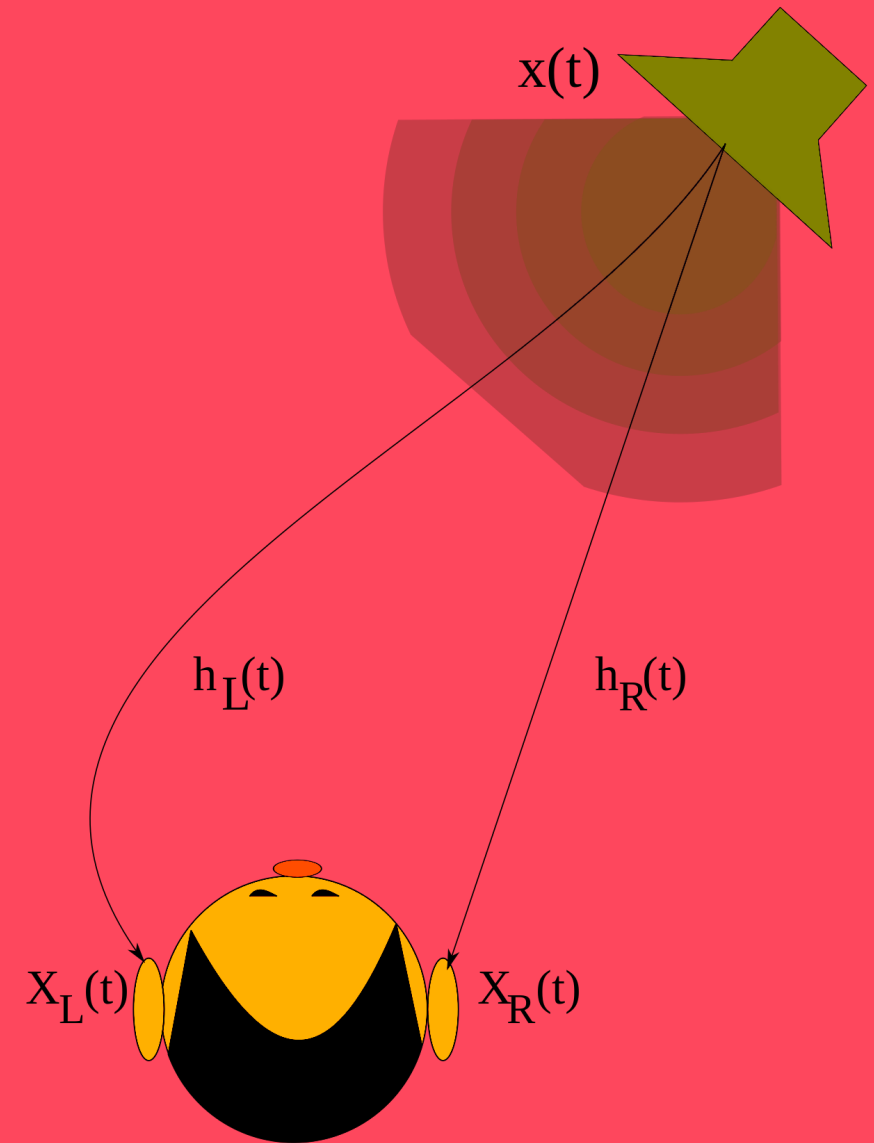
- In order to experiments with 3D audio we also wanted to test some tools for binaural representation
- We needed to find a easy way to demonstate our works (youtube and facebook supports ambisonics B-format up to 1st order)



Binaural representation

HRTF

- Humans have ability for receiving spatial sound in natural environment
- It is possible because our brains's capabilities of analyzing received signal. It can distinguish delay, amplitude and phase of received sound between ears.
- HRTF function is response that characterize how our ears receives an sound from a point of space.



Binaural representation

Klang:fabrik

The screenshot displays the STAGE software interface, which is used for creating binaural audio representations. The interface is divided into several sections:

- STAGE:** The top section shows a central 3D head model with a sound field around it. Sound sources are represented by icons and labels: "Contra Line Cntr MIC L", "OVH L", "T 2 KICK", "hh", "OVH R", "GIT AT 250", "Sx1 SOX1", "Sx2 TENOR", "Puzon", and "Tr".
- FADERS:** The middle section shows a vertical fader for each sound source, with a meter below it indicating the volume level.
- METER:** The bottom section shows a horizontal meter for each sound source, with a volume level indicator below it.
- CONTROL:** The bottom right section shows a control panel with solo/mute buttons, volume levels, and a "Clear Solo" button. The volume levels are: KICK L (-15.8 dB), sn top (-18.2 dB), sn btm (-18.7 dB), hh (-22.9 dB), T1 (-23.9 dB), T2 (-23.2 dB), OVH L (-20.5 dB), OVH R (-20.3 dB), Contra MIC L (-21.5 dB), and Contra Line (-10.7 dB). The Master Volume is set to 0.0 dB.

The interface also includes a "CONFIG" section with a gear icon and a "METER" section with a meter icon. The output section shows "User 1 OUTPUT:1", "User 2 OUTPUT:2", "User 3 OUTPUT:3", and "User 4 OUTPUT:4".



Ambisonic audio installation at Poznan Supercomputing and Networking Center
Binaural sound demo. Please wear headphones

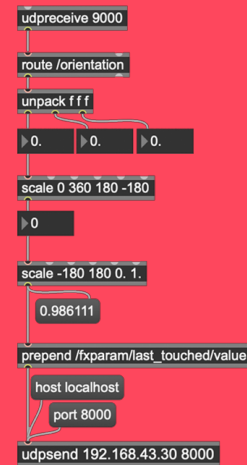
Binaural reproduction

Easy replacment

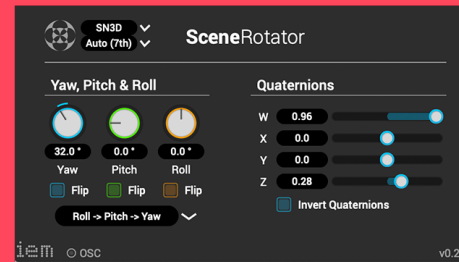
Sensor data
from phone



simple max/msp
Patch



Easy control of any
plugin's parameters



OSC
open sound control

OSC
open sound control

binaural decoded audio



Ambisonic audio installation at Poznan Supercomputing and Networking Center
Binaural sound demo. Please wear headphones

3D audio and VR

- Nowadays there are no available VR players which supports Ambisonics B format higher than 1st order
- We needed to find a way to synchronize 360° degree video with ambisonics audio



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PSNC - Poznan
Supercomputing and Networking
Center



Spin Digital Video
Technologies GmbH



Ars Electronica Linz
GmbH & Co KG



Marché du Film – Festival de
Cannes



NORRKÖPING
VISUALIZATION CENTER
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Thanks for your attention!

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